

A SYSTEM FOR ASSISTING THE REGENERATION OF DEPOLLUTION  
MEANS INTEGRATED IN AN EXHAUST LINE OF A DIESEL-ENGINED  
VEHICLE

5 The present invention relates to a system for  
assisting in regenerating depollution means associated  
with means forming an oxidation catalyst integrated in an  
exhaust line of a diesel-engined motor vehicle.

More particularly, the invention relates to a system  
in which the engine is associated with means comprising a  
10 common manifold for feeding fuel to the cylinders of the  
engine and adapted, at constant torque, to implement a  
strategy of regeneration by injecting fuel into the  
cylinders using at least one post-injection.

While depollution means, e.g. a particle filter, are  
15 being regenerated, periods during which the driver's foot  
on the vehicle accelerator is lifted (no fuel injection  
in normal operation), and periods of engine idling  
(exhaust temperature very low) are problematic since they  
cause a drop in the temperature of the exhaust, i.e. of  
20 the exhaust line and the elements included therein.

The use of one or more post-injections during these  
periods in the life of the engine enable the temperature  
drop of the exhaust line to be limited, by relying on the  
catalytic conversion of the hydrocarbons (HCs) produced  
25 by combustion of the post-injection(s) into the engine.

Nevertheless, those strategies rely on the catalyst-  
forming means operating exothermally, where said means  
are considered as being activated and comprise, for  
example, an oxidation catalyst or a NOx trap with a CO/HC  
30 oxidation function.

During periods while the engine is returning to  
idling, after the foot on the accelerator has been  
raised, there is no main injection nor any pilot  
injection, so the or each post-injection does not burn in  
35 the cylinder since it does no more than vaporize fuel in  
the form of HCs for conversion by the catalyst-forming  
means.

The inlet temperature at the oxidation catalyst-forming means is thus very low in spite of the exothermal nature of the catalytic combustion of the HCs delivered by the or each post-injection, so the front face of the catalyst-forming means cool down progressively and its conversion activity runs down progressively.

While the engine is idling, and in spite of using one or more post-injections, the temperature that the inlet to the catalyst-forming means is relatively low. The strategy of post-injection while idling also relies on catalytic conversion of the HCs produced by the combustion of the post-injection(s) into the engine. In spite of this catalytic exothermic reaction, the front face of the catalyst-forming means cools down progressively and its conversion activity runs down progressively.

During a prolonged period of idling, it can happen that the catalyst-forming means are thus no longer sufficiently active to convert all of the HCs, which leads to HC peaks downstream from the catalyst-forming means, and even to blue fumes and/or exhaust odors.

Furthermore, the use of post-injections leads to fuel diluting the lubricating oil, thereby degrading its lubricating properties, and in particular reducing its viscosity, which can lead to engine damage if the viscosity becomes too low.

The object of the invention is thus to solve those problems.

To this end, the invention provides a system for providing assistance in the regeneration of depollution means associated with oxidation catalyst-forming means, the means being integrated in an exhaust line of a diesel-engined motor vehicle in which the engine is associated with common manifold means for feeding the cylinders of the engine with fuel, and being adapted, at constant torque, to implement a strategy of regeneration by injecting fuel into the cylinders in at least one

post-injection, the system being characterized in that it comprises:

- means for detecting a regeneration request and thus a request for post-injection;
- 5       • means for detecting a period in which the engine is idling;
- means for acquiring the temperature downstream from the catalyst-forming means;
- means for determining a maximum quantity of fuel  
10 to be injected during post-injections while the engine is idling, on the basis of said temperature; and
- reduction means for progressively reducing the or each post-injection as soon as the quantity of fuel that has been injected reaches the predetermined maximum  
15 quantity.

According to other characteristics:

- the reduction means are adapted to reduce the or each post-injection in application of a calibratable slope;
- 20       • the depollution means comprise a particle filter;
- the depollution means comprise a NOx trap;
- the fuel includes an additive for becoming deposited together with the particles with which it is mixed on the depollution means in order to facilitate  
25 regeneration thereof;
- the fuel includes an additive forming a NOx trap;
- and
- the engine is associated with a turbocharger.

30 The invention can be better understood on reading the following description given purely by way of example and made with reference to the accompanying drawing, in which:

- Figure 1 is a block diagram showing the general structure of a system of the invention for providing  
35 assistance in regeneration; and
- Figure 2 is a flow chart showing its operation.

Figure 1 shows the general structure of a system for providing assistance in regenerating depollution means given overall reference 1 in the figure, and associated with oxidation catalyst-forming means given overall reference 2, being integrated in an exhaust line 3 of a motor vehicle diesel engine 4.

The engine may be associated with a turbocharger, and under such circumstances the turbine portion 5 thereof is also associated with the exhaust line, while the compressor portion 6 of the turbocharger is placed upstream of the engine.

Furthermore, the engine is also associated with means 7 constituting a common manifold for feeding fuel to the cylinders of the engine and adapted, at constant torque, to implement a strategy of regeneration by injecting fuel into the cylinders in at least one post-injection, in conventional manner.

These means are controlled by a pilot unit given overall reference 8 and adapted to detect a regeneration request req.RG, e.g. as issued by a supervisor of the depollution means, thus constituting a request for post-injection, the unit being connected to means 9 for detecting a period in which the engine is idling.

These means may have any suitable structure.

Furthermore, the pilot unit 8 is also connected to means for acquiring the temperature downstream from the catalyst-forming means 2, such acquisition means being given overall reference 11.

These means can comprise any suitable temperature sensor.

Thus, on detecting a request for regeneration and thus for post-injection, the pilot unit 8 can also detect that the engine is in an idling state, as shown by step 12 in Figure 2.

The unit 8 is then adapted to acquire the temperature downstream from the catalyst-forming means during step 13 and to determine a maximum quantity of

fuel to be injected during the post-injections while the engine is idling, on the basis of this temperature and determined in a step 14.

5 The unit 8 then acts in steps 15 and 16 to monitor the quantity of fuel injected during the post-injections and it detects the moment when said quantity of injected fuel reaches the predetermined maximum quantity.

10 In the event of the quantity of injected fuel reaching the predetermined maximum quantity while the engine is idling, as represented by step 17, the pilot unit is adapted to reduce the or each post-injection progressively, at a rate that can be calibrated at 18, for example.

15 It should also be observed that such a system can operate with depollution means constituted by a particle filter, or a NOx trap, and an additive for depositing together with the particles with which it is mixed on the depollution means in order to facilitate their regeneration can also be mixed with the fuel in  
20 conventional manner to lower the combustion temperature of soot traps therein.

In conventional manner, said additive is present in the particles after combustion of the additive-containing fuel in the engine.

25 It is also possible to envisage using an additive constituting a NOx trap.

30 With such a structure, it can thus be seen that the quantity of fuel that is allowed for post-injection during a period of idling is capped by a maximum quantity.

This maximum quantity is present in the form of a supply which is emptied during the period of idling in the regeneration period. This supply is reinitialized at the end of the period.

35 Thus, the system makes it possible to limit the quantities that are post-injected while idling when the

temperature levels in the exhaust line are the least favorable.

By limiting the total quantity of fuel that is post-injected during this period, which is not the most effective from the point of view of regenerating the depollution means, the amount of effective post-injection time is optimized and dilution of the lubricating oil of the engine with fuel is limited.

Finally, this also makes it possible to limit the risk of the oxidation function stopping suddenly, which would lead to a deficit in conversion of HCs and thus to an escape of HC in the exhaust that could lead to fumes and/or odors.

Naturally, other embodiments can be envisaged.

Thus, for example, the depollution means and the oxidation catalyst-forming means may be integrated in a single element, in particular on a common substrate.

By way of example, a particle filter integrating the oxidation function could be envisaged.

Similarly, a NOx trap integrating such an oxidation function could also be envisaged, regardless of whether it includes an additive.

This function of oxidation and/or NOx trapping can be performed by an additive mixed with the fuel, for example.